

80 were the full 35 feet long to be used for the test sections and partially for the access ramps. The remaining 52 piles were 20 feet long reflecting the decreasing depth of the access ramps.

### 5.3 Instrumentation Plan

#### 5.3.1 Overview

The data acquisition program was comprised of three components, each designed to provide redundant measurements that would allow for earth pressure calculations or estimation. The most involved component was a network of strain gages on four piles intended to give a representation of the strain along the length of the piles. The second component was an inclinometer to determine the deflection and slope of four additional piles. For redundancy, and a general check, points on the wall and within the excavation were surveyed using conventional equipment. The strain monitoring system and inclinometer are described in the following sections.

#### 5.3.2 Strain Gages and Data Acquisition System

Measurement of bending moment was done indirectly through the measurement of strain. Since the piles were steel and likely to remain in the elastic range throughout the test, the bending moment was determined through conversion of strain to curvature (Equation 5.1) then multiplying the curvature by the EI (Equation 5.2).

$$\kappa = \frac{\epsilon_C - \epsilon_T}{\bar{y}} \quad (5.1)$$

where  $\kappa$  is the curvature of the beam/pile,  
 $\epsilon_C$  and  $\epsilon_T$  are compression and tension strains,  
 $\bar{y}$  is the distance between the gages ( 8.825 in)

$$M = \kappa EI \quad (5.2)$$

where  $M$  is the bending moment  
 $E$  is Young's modulus  
 $I$  is the moment of inertia